



44

access.

5 In the foregoing embodiment, at the execution of
the recording operation, various signals for the
recording operation are supplied from the printer main
body to the external connection terminals of the head
substrate, whereby the recording execution means can
execute the recording operation when the recording
image signal and the recording clock signal are
externally entered in the first state of the binary
10 logic signal. Also at the execution of memory access,
various signals for the memory access are supplied from
the printer main body to the external connection
terminals of the head substrate, whereby the memory
access means can execute access to the data memory
15 means in a timing corresponding to the memory clock
signal, when the access permission signal is externally
entered. Thus, by utilizing a signal which corresponds
to whether or not to execute the recording operation
and does not vary during the recording operation, among
20 the signals utilized for recording, as the access
permission signal and thus switching the memory access
operation, it is rendered possible to simplify the
logic circuit within the recording head and to reduce
the number of the external connection terminals
25 thereof.

Also in the configuration where the common
terminal wiring means supplies the memory access means

with the binary logic signal entered into the external connection terminal and such memory access means recognizes the binary logic signal of the second state as the access permission signal, there is not required
5 the terminal exclusive for transferring such access permission signal to the memory access means, so that the printing head and the printer apparatus as well as the head substrate can be made smaller and lighter and superior in the production capability.

10 In the above-described head substrate, the common terminal wiring means serially supplies the memory access means with the input signal at the single external connection terminal, at which the recording image signal is serially entered, as the writing data,
15 thereby realizing input of the recording image signal and the writing data by a single external connection terminal.

In the above-described head substrate, the common terminal wiring means serially supplies an external
20 connection terminal, serially receiving the recording image signal, with the data read from the memory access means, thereby realizing input of the recording image signal and output of the read data by a single external connection terminal.

25 In the above-described head substrate, the common terminal wiring means supplies the memory access means in parallel with the input signals of plural external

connection terminals receiving parallel input of the recording image signal, thereby realizing execution of high-speed input of the recording image signal and the writing data.

5 In the above-described head substrate, the common terminal wiring means supplies the plural external connection terminals, receiving parallel input of the recording image signal, in parallel manner with data read from the memory access means, thereby realizing
10 high-speed execution of input of the recording image signal and output of the read data.

 In the above-described head substrate, the recording execution means is provided with plural recording elements for outputting the recording image
15 signal outputted in parallel from the latch circuit, corresponding to a recording pulse signal externally inputted to a specified one of the external connection terminals, whereby various signals utilized in the recording operation can be utilized for the memory
20 access by terminating the recording pulse signal for the recording elements at the execution of the memory access.

 In the above-described head substrate, the common terminal wiring means supplies the memory access means
25 with the recording clock signal of the shift register as the memory clock signal, thereby allowing to utilize an existing signal as the memory clock signal and to

simplify the circuit configuration of the printer apparatus.

In the above-described head substrate, the data memory means executes both data writing and data readout as the memory access operation, while the memory access means selectively executes either of data writing and data readout according to an externally entered mode switching signal, and the common terminal wiring means supplies the memory access means with the input signal to a specified one of the external connection terminals, whereby the data memory means can execute both data writing and data readout.

In the above-described head substrate, the recording execution means externally receives the driving electric power from a specified external connection terminal, and the common terminal wiring means supplies the memory access means with the driving electric power for the recording execution means, thereby allowing to dispense with the external connection terminal for supplying the memory access means with the driving electric power and to reduce the dimension and weight of the printing head and the printing apparatus.

In the above-described head substrate, the external connection terminals, recording execution means, data memory means, memory access means and common terminal wiring means are composed of films

formed on a base substrate, whereby the printing head can be formed compact and light.

[Second embodiment]

In the foregoing embodiment, there has been
5 explained a configuration in which, among the recording signals supplied in the head, a signal corresponding to whether or not to execute the recording operation and not varying during the recording operation is used as the access signal for the memory provided in the head.

10 In the above-described configuration in which a signal is used in common for the access to the data and for the recording operation, the data stored in the memory may be altered by a noise or the like in the recording operation, but the present embodiment is
15 featured by a fact that the data in the memory of the head are not overwritten even in case a signal is used in common for the recording operation and for the data access.

The recording operation, the memory access
20 operation and the circuit configuration therefor are same as those in the foregoing embodiment and will not, therefore, be explained further.

Fig. 9 shows the circuit configuration of the head substrate of the present embodiment. The recording
25 operation, the memory access operation and the circuit configuration therefor are same as those in the foregoing embodiment and will not, therefore, be

explained further.

5 The fuse logic circuit 442 is also connected to
the pair of memory power supply terminals 447, 448
constituting external connection terminals, whereby the
driving electric power required for the fuse logic
circuit 442 in executing the data writing into the fuse
ROM 441 is supplied from such memory power supply
terminals 447, 448.

10 In the present embodiment, however, an electric
power fuse 449 constituting writing inhibition means is
inserted in the electric power wiring connecting the
memory power supply terminals 447, 448 and the fuse
logic circuit 442, and the connection between the
memory power supply terminals 447, 448 and the fuse
15 logic circuit 442 is cut off by the fused electric
power fuse 449 at the shipment of the printing head
400, whereby the data writing by the fuse logic circuit
442, into the fuse ROM 441 is permanently disabled.

20 In case the external connection terminals for the
printing head 400 are used in common for the recording
operation and for the memory access, the noise
generated at the execution of the recording operation
of the ink jet printer may intrude as writing data into
the fuse logic circuit 442.

25 However, in the printing head of the present
embodiment, as shown in Fig. 11, various data are
written into the fuse ROM 441 by the fuse logic circuit

442 prior to the shipment of the printing head but the electric power fuse 449 is cut off at the shipment thereof.

Therefore, in the printing head 400 shipped as the product, the driving electric power required for data writing cannot be supplied from the memory power supply terminals 447, 448 to the fuse logic circuit 442, so that the data writing by the fuse logic circuit 442 into the fuse ROM 441 is not realized even if a noise is generated in the course of the recording operation.

In Fig. 11, there are shown processes for writing/reading out data representative of a resistance value of the head heater. In the summary of operations, the left represents a preparatory process for conducting each operation and the right represents an operation actually executed at the head side.

As afore-mentioned, in the ink jet printer 300 of the present embodiment, the data stored in the fuse ROM 441 of the printing head 400 cannot be overwritten by the noise, so that the necessary data stored in the fuse ROM 441 cannot be lost and can always be exactly read from the fuse ROM 441.

The substrate described in the present embodiment can naturally be applied to the configuration of the printing head or of the printer apparatus as explained in the foregoing embodiment.

Also, variations relating to the recording

operation and the memory access, explained in the foregoing embodiment, are also applicable to the present embodiment.

In the foregoing, it has been explained to write
5 all the necessary data into the fuse ROM 441 and then
to disable overwriting of all the data by fusing the
electric power fuse 449. It is however also possible,
as shown in Fig. 12, to write data of plural kinds in
succession into the fuse ROM 441 and to individually
10 disable overwriting of the written data of plural kinds
in the order of writing. That is, when producing the
head substrate, the writing of the ROM is disabled
after writing the resistance value in the ROM. Then,
after producing the head, the writing of the ROM is
15 disabled after writing the head ID in the ROM. Such
configuration can be realized by providing plural fuse
ROM's 441 and plural electric power fuses 449.

For example, as shown in Fig. 12, the function
characteristics of the heater unit 412 are written and
20 the overwriting is disabled in the fuse ROM 441 at the
completion of the head substrate 410, and the head ID
is written and the overwriting is disabled at the
completion of the printing head 400. In this manner it
is possible to write various data at appropriate
25 timings in non-rewritable manner, and the data of the
function characteristics cannot be overwritten even if
a noise is generated at the writing of the head ID.

Also in the foregoing, it has been explained to cut off the power supply wiring between the fuse logic circuit 442 and the memory power supply terminals 447, 448 by the electric power fuse 449, in order to disable data overwriting of the fuse ROM 441 after the data writing. However, it is also possible to cut off the signal wiring for the access permission signal for data writing, in case the signal wiring for entering the access permission signal to the fuse logic circuit is provided separately for the data writing and for the data readout.

The present embodiment, constructed as explained in the foregoing, further provides the following advantages.

As the data writing into the data memory means by the memory access means is permanently disabled by the writing inhibition means, the data stored in the data memory means cannot be overwritten by a noise, eventually intruding into the memory access means from the external connection terminals in the course of the recording operation, and necessary data cannot be lost and can always be read exactly.

In the above-described head substrate, the writing inhibition means cuts off the electric power wiring for supplying the driving electric power for data writing from the external connection terminals to the memory access means, whereby the data overwriting by the

memory access means can be securely prevented as such driving electric power for data writing is not supplied to the memory access means.

In the above-described head substrate, a specified one of the external connection terminals externally receives the access permission signal for permitting the data writing, while the memory access means executes data writing into the data memory means upon externally receiving the access permission signal from the external connection terminal, and the writing inhibition means cuts off the signal wiring for supplying the access permission signal for data writing from the external connection terminal to the memory access means, whereby the data overwriting by the memory access means can be securely prevented since the access permission signal required for data writing is not supplied to the memory access means.

In the above-described head substrate, the memory access means writes data of plural kinds in succession into the data memory means, and the writing inhibition means individually disables the overwriting of the data of plural kinds writing in succession into the data memory means by the memory access means, whereby the data of plural kinds can be written and overwriting can be disabled, at appropriate timings.

In the producing method for the head substrate and the printing head of the present invention, the common

terminal wiring means connects the memory access means
and the recording execution means to a common external
connection terminal, but the data writing into the data
memory means by the memory access means is permanently
5 disabled after the completion of data writing into the
data memory means by the memory access means, whereby
it is rendered possible to produce a head substrate and
a printing head in which the necessary data cannot be
lost and can always be read exactly, since the data
10 stored in the data memory means are not overwritten by
the noise, eventually intruding into the memory access
means from the external connection terminal, in case
the recording operation is executed by mounting the
printing head in the printer apparatus.

15 In the producing method for the above-described
head substrate and printing head, the electric power
wiring for supplying the driving electric power for
data writing from the external connection terminals to
the memory access means in order to permanently disable
20 the data writing into the data memory means by the
memory access means, whereby it is rendered possible to
provide a head substrate and a printing head in which
the data overwriting by the memory access means is
securely prevented since the driving electric power
25 required for data writing is not supplied to the memory
access means.

In the producing method for the above-described

head substrate and printing head, the signal wiring
connecting the external connection terminal, externally
receiving the access permission signal for permitting
the data writing, and the memory access means is cut
5 off in order to permanently disable the data writing
into the data memory means by the memory access means,
whereby it is rendered possible to provide a head
substrate and a printing head in which the data
overwriting by the memory access means is securely
10 prevented since the driving electric power required for
data writing is not supplied to the memory access
means.

WHAT IS CLAIMED IS:

1. A head substrate of a printing head detachably mounted on a printer main body, comprising:

5 plural external connection terminals individually receiving, from the exterior, a binary logic signal corresponding to whether or not to execute a recording operation, a recording image signal and a clock signal;

10 recording execution means for executing the recording operation according to the recording image signal and the clock signal entered through said external connection terminals, in case said binary logic signal is in a first state;

15 data memory means for executing a memory access which is at least either of data writing and data readout; and

20 memory access means for recognizing said binary logic signal as an access permission signal and executing the memory access to said data memory means at a timing corresponding to the clock signal when said logic signal is in a second state.

2. A head substrate according to claim 1, wherein said external connection terminals include:

25 first common terminal wiring means for supplying said externally entered binary logic signal to said memory access means and to said recording execution means; and

second common terminal wiring means for supplying said externally entered clock signal as a recording clock signal to said recording execution means and as a memory clock signal to said memory access means.

5

3. A head substrate according to claim 2, wherein:

10 said recording execution means is adapted for executing the recording operation based on the recording image signal serially entered into one of said external connection terminals; and

15 said common terminal wiring means is adapted for serially supplying said memory access means with the input signal to the same external connection terminal that receives the serial input of the recording image signal, as writing data.

4. A head substrate according to claim 2, wherein:

20 said recording execution means is adapted for executing the recording operation based on the recording image signal serially entered into one of said external connection terminals; and

25 said common terminal wiring means is adapted for serial supply of read data of said memory access means to the same external connection terminal that receives the serial input of the recording image signal.

5. A head substrate according to claim 2,
wherein:

said recording execution means is adapted for
executing the recording operation based on the
5 recording image signal parallel entered into plurality
of said external connection terminals; and

said common terminal wiring means is adapted for
parallel supplying to said memory access means an input
signal to said plural external connection terminals
10 that receive the parallel input of the recording image
signal, as writing data.

6. A head substrate according to claim 2,
wherein:

15 said recording execution means is adapted for
executing the recording operation based on the
recording image signal parallel entered into plurality
of said external connection terminals; and

said common terminal wiring means is adapted for
20 parallel supplying read data of said memory access
means to said plural external connection terminals,
receiving the parallel input of the recording image
signal.

25 7. A head substrate according to any of claims 2
to 6, wherein:

said recording execution means includes a shift

register which is reset by a reset signal externally entered into one of said external connection terminals and is adapted to temporarily hold and parallel output, at a timing corresponding to the clock signal, the recording image signal serially entered into another of said external connection terminals; and

said common terminal wiring means is adapted for supplying said memory access means with the reset signal for said shift register, as said binary logic signal constituting said access permission signal.

8. A head substrate according to any of claims 2 to 6, wherein:

said recording execution means includes a shift register which is adapted to be reset by a reset signal externally entered into one of said external connection terminals and then to temporarily hold and parallel output, at a timing corresponding to the clock signal, the recording image signal serially entered into another of said external connection terminals, and a latch circuit which is adapted to be reset by said reset signal and then to temporarily hold and output the recording image signal parallel outputted from said shift register; and

said common terminal wiring means is adapted for supplying said memory access means with the reset signal for said latch circuit, as said binary logic

signal constituting said access permission signal.

9. A head substrate according to any of claims 2 to 6, wherein:

5 said recording execution means includes a shift register which is adapted to be reset by a reset signal externally entered into one of said external connection terminals and then to temporarily hold and parallel output, at a timing corresponding to the clock signal,
10 the recording image signal serially entered into another of said external connection terminals, and a latch circuit which is adapted to be reset by said reset signal and then to temporarily hold and output the recording image signal parallel outputted from said
15 shift register; and

 said common terminal wiring means is adapted for supplying said memory access means with said reset signal as said binary logic signal constituting said access permission signal.

20

10. A head substrate according to any of claims 2 to 6, wherein:

 said recording execution means includes a shift register which is adapted to be reset by a reset signal
25 externally entered into one of said external connection terminals and then to temporarily hold and parallel output, at a timing corresponding to the clock signal,

the recording image signal serially entered into
another of said external connection terminals, and a
latch circuit which is adapted to temporarily hold and
output the recording image signal parallel outputted
5 from said shift register at a timing corresponding to a
latch signal externally entered into still another of
said external connection terminals; and

said common terminal wiring means is adapted for
supplying said memory access means with said latch
10 signal as said binary logic signal constituting said
access permission signal.

11. A head substrate according to any of claims 1
to 6, wherein said recording execution means includes
15 plural recording elements for recording the recording
image signal parallel outputted from said latch
circuit, corresponding to a recording pulse signal
externally entered into one of said external connection
terminals.

20 12. A head substrate according to claim 11,
wherein said recording element is a heat generating
element.

25 13. A head substrate according to any of claims 2
to 6, wherein said common terminal wiring means is
adapted to supply said memory access means with the

clock signal for said recording image signal, as a
memory clock signal.

14. A head substrate according to any of claims 2
5 to 6, wherein:

said data memory means is means for executing both
data writing and data readout as the memory access;

said memory access means is means for selectively
executing either of data writing into and data readout
10 from said data memory means corresponding to an
externally entered mode switching signal; and

said common terminal wiring means is adapted for
supplying said memory access means with the input
signal to one of said external connection terminals as
15 the mode switching signal.

15. A head substrate according to any of claims 2
to 6, wherein:

said recording execution means is adapted for
20 receiving a driving electric power externally entered
from one of said external connection terminals; and

said common terminal wiring means is adapted for
supplying said memory access means with the driving
electric power for said recording execution means.

25

16. A head substrate according to any of claims 2
to 6, wherein said external connection terminals, said

recording execution means, said data memory means, said memory access means and said common terminal wiring means are constituted by films formed on one base substrate.

5

17. A printing head detachably mounted on a printer main body, comprising a head substrate according to any of claims 1 to 6.

10

18. A printing head according to claim 17, wherein said recording execution means includes plural recording elements for recording.

15

19. A printing head according to claim 18, wherein said recording element is a heat generating element.

20

20. A printing head according to claim 19, wherein the recording is executed by discharging ink by the heat generated by said heat generating element.

21. A printing head detachably mounted on a printer main body, comprising:

25

plural external connection terminals individually receiving, from the exterior, a binary logic signal corresponding to whether or not to execute a recording operation, a recording image signal and a clock signal;

recording execution means for executing the recording operation according to the recording image signal and the clock signal entered through said external connection terminals, in case said binary
5 logic signal is in a first state;

data memory means for executing a memory access which is at least either of data writing and data readout; and

memory access means for recognizing said binary
10 logical signal as an access permission signal and executing the memory access to said data memory means at a timing corresponding to the clock signal when said logical signal is in a second state.

22. A printing head according to claim 21,
15 wherein said external connection terminals include:

first common terminal wiring means for supplying said externally entered binary logic signal to said
memory access means and to said recording execution
20 means; and

second common terminal wiring means for supplying said externally entered clock signal as a recording clock signal to said recording execution means and as a memory clock signal to said memory access means.

25

23. A printing apparatus comprising:
a printing head according to claim 17;

input means for individually transmitting the binary logic signal of the first state and various signals such as the recording image signal and the clock signal respectively to plurality of said external connection terminals of said printing head, thereby causing said recording execution means to execute a recording operation; and

access control means for transmitting the binary logic signal of the second state and the clock signal, etc. to said plural external connection terminals of said printing head, thereby causing said memory access means to execute the memory access.

24. A printing apparatus comprising:

a printing head according to claim 21;

input means for individually transmitting the binary logic signal of the first state and various signals such as the recording image signal and the clock signal respectively to said plurality of external connection terminals of said printing head, thereby causing said recording execution means to execute a recording operation; and

access control means for transmitting the binary logic signal of the second state and the clock signal, etc. to said plural external connection terminals of said printing head, thereby causing said memory access means to execute the memory access.

25. A printing apparatus according to claim 23,
wherein:

said input means is adapted for serial
transmission of the recording image signal to a
5 specified one of said external connection terminals;
and

said access control means is adapted for serial
transmission of the writing data for said memory access
means to one of said external connection terminals in
10 which the recording image signal is serially entered.

26. A printing apparatus according to claim 23,
wherein:

said input means is adapted for parallel
15 transmission of the recording image signal to a
specified plurality of said external connection
terminals; and

said access control means is adapted for parallel
transmission of the writing data for said memory access
20 means to said plurality of external connection
terminals in which the recording image signal is
parallel entered.

27. A printing apparatus according to claim 23,
25 wherein said recording execution means includes a heat
generating element for recording.